United States Military Academy
West Point, New York 10996

ANNUAL REPORT

OF THE

OPERATIONS RESEARCH CENTER

FOR

ACADEMIC YEAR 2001

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PART I - The Operations Research Center of Excellence (ORCEN)

PURPOSE OF THE OPERATIONS RESEARCH CENTER

The purpose of the Operations Research Center is to provide a small, full-time analytical capability to both the Academy and the United States Army. The Operations Research Center helps to fill several Academy needs:

(1) enriched education for cadets;
(2) enhanced professional development opportunities for Army faculty;
(3) strong ties between the Academy and Army agencies; and
(4) the integration of new technologies into the academic program.

By being fully engaged in current Army issues, the Operations Research Center assures that systems engineering education at West Point remains current and relevant. The one-year experience tour with the ORCEN offers officers assigned to the Academy as faculty the opportunity to engage in meaningful applied research and problem solving activities that both further enhances their soldierly professional development and keeps them current in their discipline. The Army's return on its investment is meaningful career development experiences for officers, especially those in Functional Areas 49/51/53, and important investigation of vital Army problems at far less cost than would be required through civilian contracts.

Operations Research Center projects provide the faculty and cadets with the opportunity to investigate a wide spectrum of interdisciplinary, systemic issues and to apply many of the systems engineering, engineering management, and operations research concepts studied in the classroom to real-world problems of interest to the Army. These projects demonstrate for both cadets and faculty the relevance and importance of systems engineering in today's high technology Army.

ORGANIZATION OF THE OPERATIONS RESEARCH CENTER

Personnel authorizations in the ORCEN are established by a Table of Distribution and Allowances (TDA). Funding support for the Operations Research Center is established by a Memorandum of Agreement with the Office of the Assistant Secretary of the Army (Financial Management & Comptroller). The Operations Research Center is organized under the Office of the Dean as an Academy Center of Excellence. A permanent Military Academy professor provides oversight and supervision to the Center. In addition, the TDA authorizes one analyst, O5; three analysts, O4; and one secretary, GS5. By agreement between the Department of Systems Engineering (D/SE) and the Department of Mathematical Sciences (D/MATH SCI), three analysts are assigned to the ORCEN by D/SE, and one analyst comes from the D/MATH SCI. The Department of Systems Engineering also provides the permanent faculty member to serve as the Director, and one permanent staff member to serve as Executive Administrator and assistant to the Director.

The Operations Research Center welcomes the opportunity to collaborate on Army-related projects with USMA teaching faculty from the Departments of Systems Engineering, Mathematical Sciences, and others. In addition, the ORCEN is able to provide Army officers attending graduate school and cadets enrolled in advanced individual study courses with real-world projects that are well suited for either thesis work or course projects. This in turn provides Army agencies with a greater range of expertise to address a wide spectrum of projects.

The Operations Research Center occupies office and laboratory space in the Department of Systems Engineering on the third floor of Mahan Hall. The Center includes offices for the director and analysts, and a briefing area. The Department of Systems Engineering laboratories -- Combat Simulation, Systems Management and Design, Computer Aided Design, and Installation Management and Engineering -- are located within easy access to the Operations Research Center.

The Operations Research Center is sponsored by the Assistant Secretary of the Army (Financial Management & Comptroller). Fully staffed and funded since Academic Year 1990-1991, the Operations Research Center has made significant contributions to cadet education, faculty development, and the Army at large.

PERSONNEL

The following is a list of the Operations Research Center positions and personnel assigned during FY01.

CONTRIBUTING ORGANIZATION	NAME	PHONE	EMAIL
Head, DSE:	COL Michael L. McGinnis, Ph. D.	688-2701	fm0768@usma.edu
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Analyst (DSE):	MAJ Ricardo Morales	688-5663	fr4874@usma.edu
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Analyst (D/MATH SCI):	MAJ Michelle McCassey	688-4383	am5410@usma.edu

These full-time analysts are augmented by permanent faculty who serve as senior investigators for each project, as well as by instructors from the Department of Systems Engineering, the Department of Mathematical Sciences, and other departments who work

as primary analysts or co-analysts on ORCEN projects. Contributors for AY01 are listed in the following table.

TITLE	NAME	PHONE (DSN)	EMAIL
Professor	Gregory Parnell, Ph.D.	688-4374	fg7526@usma.edu
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Instructor	MAJ Todd Henry	688-4752	ft4355@usma.edu
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LABORATORY RESOURCES

Systems Management and Design Lab (SMDL)

This lab is designed to facilitate group design work, ideation and sharing. Presentation and conferencing facilities are part of the lab. The principle function of the lab is to facilitate cadets working as groups as they move through the systems engineering design process, particularly the formulation and interpretation of alternatives steps. A secondary purpose is to provide a sophisticated meeting and briefing place for all kinds of groups with the capability to enhance their work. Lab equipment is designed to be reconfigurable to accommodate different size groups and organizations.

The lab's 17 workstations are IBM-compatible personal computers with a Pentium/300 processor, 64 MB RAM, 4.3 GB hard disk drive, 3-1/2" floppy drive, CD-ROM, SVGA graphics card, 17" multisync monitor, and SMC ethernet card. This capability allows cadets to use advanced software and peripherals for high-speed data processing and high quality graphics. One of these workstations is used as the facilitator's workstation while the others are nodes in the CSCW software package (GroupSystems V).

Installation Management and Engineering Annex

The Installation Management and Engineering Annex (IMEA) to the SMDL provides cadets and faculty with the tools needed to study installation management and power projection related issues. Engineering Management cadets use Geographic Information System (GIS) and other engineering analysis software in the Introduction to Systems Design for Engineering Managers (SE411) as well as in the follow-on capstone design courses (SE421). Other cadets use the facility to conduct in-depth research in advanced individual study courses (SE 489).

The hardware configuration of the IMEA consists of five high-end PC based graphics workstations. These include a Intergraph TD 300 graphics workstation. The TD300 supports the graphic intensive software programs in Intergraph's MGE product suite, in

addition to the underlying ORACLE databases. In addition to the GIS, these workstations also run MS Project, AutoCAD, and software specific to installation management.

Combat Simulation Laboratory

The Combat Simulation Laboratory (CSL) offers state-of-the-art simulation and analysis tools for virtual prototyping, testing and evaluation in distributed and non-distributed environments. Cadets combine premier Army simulations and commercial-off-the-shelf (COTS) modeling tools to gain insight into real-world Army problems. Cadets build a foundation in Combat Modeling (SE 485) and apply their knowledge in System Design I and II (SE 402/403) and in Advanced Individual Study in Systems Engineering or Engineering Management (SE 489). ORCEN analysts and department faculty use the facility to approach a variety of problems.

Janus, ModSAF, NPSNET, EADSIM, and ITEMS are the primary simulations. JETS, the Janus Evaluator's Tool Set, is the main analysis tool and simulation browser. Simulation output may be analyzed directly through JETS or exported to a variety of other tools, such as Minitab. COTS tools include MultiGen II and MultiGen II Pro 3D modeling software. Hardware includes an Onyx Infinite Reality graphics supercomputer, 6 Silicon Graphics Indigo II workstations, 2 Hewlett-Packard K-class superminis and an HP 735 computer, 2 Sun SPARC 10s, a SPARC 2, and a 670MP server, 11 X-terminals, and a pentium PC. All hardware is networked through a Cisco 5000 switch to the Internet via fiber optic cable.

PART II - Principal Research Activities for AY01

UTILITIES PRIVATIZATION IN THE US ARMY: ECONOMIC ANALYSIS AND PROCESS IMPROVEMENT STRATEGIES

Client Organization: Assistant Secretary of the Army – Financial Management & Comptroller (ASA – FM&C)

Points of Contact:

Name:	Address:	Phone:	Other:
Dr. Robert Raynsford	Deputy ASA for Resource Analysis and Business Practices	DSN: 7-2281	raynsofrdR@hqda.army.mil
Mr. Rod Brickson		(703) 614-6184 DSN: 224	brikcrm@hqda.army.mil

Problem Statement:

ASA (FM&C) is partnered with The Assistant Chief of Staff for Installation Management (ACSIM), the lead agency, in the execution of the Army's Utilities Privatization Program. Two Secretary of Defense directives provide the backdrop for this project, 1997 Defense Reform Initiative directs DOD leaders to "reengineer" business practices and a 1998 initiative directing the development of a plan to privatize all utility systems: electric, natural gas, water, wastewater and drainage. The ORCEN will support this effort by developing a decision support tool in the form of an economic analysis and an outline of methodologies in the form of an illustrative case for consideration by Installation Commanders.

Proposal of Work:

1. Perform an extensive literature review and develop an expert understanding of the existing programs, laws, directives, and procedures. Specifically draft, develop and deploy an economic analysis that:

(a) serves as a template for ongoing decision-making and evaluation for installation commanders undergoing utility privatization efforts,

(b) identifies appropriate finance techniques and valuations for existing infrastructures, and

(c) provides flexibility of use and application at diverse installations Armywide.

Research effort will improve a process that has had few and economic analysis proposals approved at the DA Secretariat level.

2. Products. Develop a comprehensive Case Study that highlights the Utility Privatization efforts of Fort Hamilton, NY – the first Army Installation to complete a total privatization proposal and begin implementation of large-scale outsourcing by a civilian firm. The production and distribution of all utilities are being contracted out to a single firm in a

ground-braking manner that redefines both contracting and facilities management at the installation. The case serves two significant purposes:

- disseminate lessons to Army Installation commanders, DPW staffs, and planners who are working to meet DOD imposed privatization deadlines
- serves as a relevant application of real-world economic analysis and operations research
- vehicle for further research by both faculty and cadets at USMA and potential join examination by faculty and students at Vanderbilt University

3. Endstate. Provide project management recommendations and assist in drafting implementation recommendations for all proposed improvements. Track the progress of the changes and asses effectiveness in an effort to facilitate future process improvements and transition follow-on research and consulting efforts by ORCEN analysts.

Principal Analyst MAJ Ricardo Morales

Senior Investigator: LTC Mark J. Davis

Status: Complete. Fall academic conference and continued collaboration as necessary.

Summary:

Privatization of utilities within the United States Army and throughout the Department of Defense is an on-going initiative to improve infrastructure and focus the allocation of resources toward a core mission – responding to national security threats. A study on privatization at Fort Hamilton, NY (one of the first installations in DOD to grapple with privatization of utilities) provides insight into project management, finance, labor relations, systems design, and strategy formulation. This study examines economic models, decision support templates and strategies for implementation of privatization of public sector services. The contribution made by ORCEN research extends beyond sharing lessons learned at Fort Hamilton and includes support in the development of a web-deployed Department of Defense Economic Analysis Tool, participation in a Department of the Army level Public Private Partnership Study, and frequent interaction with senior decision-makers and staff at all levels of the privatization effort.

Privatization decisions are complex and involve multiple stakeholders, disciplines, and objectives; consequently, Systems Engineering methodologies are ideally suited to examine this process. Consequently it is important to examine the impact of privatization on readiness, reliability, safety, and the ability to focus on core competencies, and financial management. To that end, the ASA FM&C, Resource Analysis and Business Practices scoped ORCEN research into three primary areas:

- Hamilton's decision to bundle all utility services as part of bidding
- Economic Analysis
- privatization processes employed Fort Hamilton

Because of Fort Hamilton's relatively small size, unique mix of active-duty and reserve forces, and frequent candidacy for base realignment, some lessons from this privatization effort are not readily transferable; however, significant universal lessons can be drawn from the decisions, partnerships, and implementation of public-private partnerships at Fort Hamilton. As an early test case, Fort Hamilton provides much needed insight. Interviews with Fort Hamilton installation commanders and other leaders involved in the privatization process reveal that the Army is as focused as any service in this area, but the overall process has proceeded at a very slow pace – primarily because of the complexity of the problem. Unfortunately, a well synchronized, detailed, and comprehensive plan for the privatization of utilities has only recently been refined. Privatization of utilities appears to have had a rough start as evidenced by confusion at installations and in the private sector, vague legal requirements, and revised contracting procedures; nonetheless, it is clear that organizations like the ACSIM and DESC remain focused and prepared to carry out energy mandates. Fort Hamilton, after all, is a success story not a failure, and must be examined holistically while focusing on areas needing improvement to gain maximum value from any analysis.

A candid installation commander (LTC Frank Clepper), intent on sharing lessons rather than merely trumpeting his success, describes a lack of organizational focus and poor preparation for the rigors of privatization at Hamilton. Privatization timeline revisions, local concerns that utilities reform might be a passing initiative or a threat to job security, and a lack of standardization from installation to installation (thus creating confusion in the private sector) were difficult hurdles to overcome.

Commanders must keep accurate asset inventories and ensure that true costs for services are measured. Inventories at Fort Hamilton and other installations are out of date and provide only minimal support to the valuation effort. Despite being contracted out to a professional AE firm, Gurnesy, the accuracy of government costs were questionable because of an incomplete material condition status. Similarly, and equally important, commanders in the field do not have a true sense for the costs associated with running their utilities, nor are they equipped to asses the performance and reliability of their existing systems. Activity Based Costing, an ASA FM&C initiative, will force commanders to better understand their operations and dramatically improve installation efficiency.

Consistent contracting terms and conditions and evaluation criteria must be established. As privatization issues involve real estate, funding, and other Major Command (MACOM) responsibilities, it is important that all levels of installation management are involved in the process and expertise is tapped at each level. The Request for Proposal at Fort Hamilton was primarily drafted at the MACOM level at the Military District of Washington with little input from New York. Fort Hamilton's size made this decision prudent, but insulating local commands from decision-making will likely lead to implementation concerns downstream. It is important to assemble a local interdisciplinary team to work selection and implementation.

An examination of the underlying economics of the privatization decision at Fort Hamilton coupled with fundamental finance and engineering economic analysis principles is an important part of this research effort. A major contribution in this area took the form of a web-deployed Economic Analysis tool geared specifically at privatization of utilities. Other economic questions beyond finance are also important. For instance, the bundling of

utilities where possible and economically advantageous is both legal (concerns about limiting competition must be weighed carefully and again highlight the need for legal review and interdisciplinary teams) and establishes an improved managerial environment for installation commanders to address energy issues. This improved managerial control streamlines operations by allowing installations to deal with a single contractor rather than several unique organizations each with their own procedures. Enron Federal Solutions was able to reduce friction between contractors by serving as a single point of contact for planning, daily operations, and maintenance. Given the improved service and potential for future commodity incorporation into operations, it is clear that Economic Analysis provides only a partial solution and that privatization decisions must consider the "best value" for the Army in both the short and long run. Fort Hamilton is a powerful example of the fiscal benefit of private capital invested in aging faculties resulting in a reduced managerial footprint for commanders.

Utilities privatization initiatives are building momentum Army-wide despite early confusion regarding the end-states and process flow. This study also examines Fort Hamilton's initiative and the Army's efforts to get privatization right as compared to the efforts of sister services, municipalities, and other government agencies. This contrast in many cases validates the work to date and in others points an azimuth for future efforts and assists in the development of both local and Army strategies. A strategic component to the ORCEN contributions this year came in the form of serving as a conduit to current Army-wide initiatives including participation as part of a Public Private Partnership task force chaired by the Assistant Secretary for Installations and Environment (Mr. Apgar) in late Fall of 2000 and work with KPMG on an economic analysis tool in the Spring of 2001. Privatization lessons were also shared at a May 2001 Installations 2010 conference, several smaller workshops (including one hosted at the Military Academy by the ORCEN in December of 2000), and continual dialogue with leaders at ACSIM, DESC, the Corps of Engineers Energy Support Center at Huntsville, and across all services.

Presentations and Publications:

Privatization:

- MAJ Ricardo O. Morales - Privatization of Utilties at Fort Hamilton: Understanding Process and Implimentation Issues. Workshop hosted by the ORCEN. Participant included private industry, management consultants teamed on the Public Private Task Force, and representatives from Fort Hamilton, December 2000.
- Public Private Partnership Task Force. Result of two month study in support of the Assistant Secretary of the Army for Installations and Environment, briefed at the Senior Installation Leaders Conference, January 2001.
- MAJ Ricardo O. Morales Winter Boyd Conference. Discussion on Military Innovation: Re-examing Infrastrucure Management, Army Utility Privatization Efforts. February 2001.
- MAJ Ricardo O. Morales and LTC Mark J. Davis. Fort Hamilton, NY Case Study: A Systems examination of Privatization of Utilities at a US Army Installation. American Society of Engineering Management Conference, Huntsville, AL, October 2001.
- KPMG (Kapil Gupta) and Ricardo Morales. Contribution to underlying economics, formulation and review of test versions: Economic Model for Valuation of Utility

Systems. May 2001. Model available at:
http://www.acq.osd.mil/installation/utilities/privatization.htm

- Morales, Ricardo O. The United States Army's Utilties Privatization Program: Exploring the Dynamics of Large-Scale Infrastructure Transformation. International Society for Systems Dynamics Conference, Session on Military Applications and Innovation. July 2001.
- MAJ Ricardo O. Morales and LTC Mark J. Davis. Technical Report. Privatization of Utilties at Fort Hamilton, New York: Lessons for Installations and Recommendations for Strategic Improvements. August 2001.

Other:

- Morales, Ricardo O., Randall, Klingaman, Barry C. Ezell, and Michael L. McGinnis, "Applying Cluster Analysis to Develop a Uniform Joint Task List", presented preliminary research and findings to the Joint Warfare Session of the Military Operations Research Society, Annapolis, MD June 2001.
- Klingaman, Randall, Ricardo O. Morales, Barry C. Ezell, and Michael L. McGinnis, "Using Cluster Analysis to Develop a Uniformed Joint Task List For Rapid Decisive Operations", IEEE 2001 International Conference on Systems, Man and Cybernetics, to be published in the October 2001 Proceedings.
- Kwinn, Michael J. and Ricardo. O. Morales, "So You Say You Want a Revolution?: A perspective on Future Combat System Design and Army Transformation", to be published in the Council of Emerging National Security Affairs publication on innovation in National Security. December 2001.

Personnel Briefed:

- Mr Rod Brickson, ASA_FM&C (Resource Analysis and Business Practices), Sponsor, The Pentagon, October 2000-July 2001.
- Dr. Robert Raynsford, Deputy Assistant Secretary of the Army for Resource Analysis and Business Practices. The Pentagon, in brief October 2000, In Progress Reviews (IPRs), and out brief August 2001.
- Mr. Sandy Apgar, Assistant Secretary of the Army for Installations and Environment. Association of United States Army Annual Conference, Washington, DC, November 2000.
- Account Managers and Consultants from Enron Federal Services, McKinsey & Company, and KPMG Consulting, The Pentagon and Corporate Offices in Washington and Virginia, November 2000 – July 2001.
- COL R. Keyser, Office of the Assistant Chief of Staff of the Army for Installation Management (ACSIM), In Progress Review (IPR), The Pentagon, December 2000.
- Fort Hamilton Utilities Contractors, Installation Staff (West Point), and McKinsey Management Consultants, Privatization Workshop, West Point, NY, December 2001.
- LTG (Retired) Noah, US Army Engineer Association, The Pentagon, April 2001.

- Mr Mark Iden, Defense Energy Support Center (DESC), Utilities Privatization Center. January 2001.
- Mr. Ed Rutherford, Military District of Washington Privatization Team, Washington, DC March 2001.
- LTC Gettig, Installation Commander Fort Hamilton, in preparation for an Army Engineer Association Briefing, May 2001.

A FRAMEWORK FOR THE ANALYSIS OF THE FUTURE COMBAT SYSTEM CONCEPTUAL DESIGN ALTERNATIVES

Client Organization: Office of the Program Manager, Future Combat System (PM,FCS)

Points of Contact:

Name:	Address:	Phone:	Other:
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Ms. Ellen Purdy	PM FCS		

Problem Statement

Execute a systems analysis of the Future Combat System within an integrated task force design for the purpose of developing appropriate metrics for the FCS as a whole and its component sub-systems. Identify attributes of potential FCS designs for subsequent modeling and evaluation.

Proposal of Work:

The Operations Research Center of Excellence (ORCEN) executed a year-long research project on behalf of PM, FCS identifying and developing performance metrics for use in analyzing conceptual designs of the future combat system. Research included a survey of existing performance metrics within DOD operational analysis and acquisition communities. A key contribution of the research is to take a systems approach – analyzing FCS design within the context of an integrated, network-centric force. Systems analysis work considers the broad spectrum of operations to which the FCS equipped force may be deployed and in which it may be employed. Metric development considers non-traditional areas such as unique and shared contributions of FCS to the C4ISR capabilities of the integrated force. Work is sensitive to scenarios in which presumed, enemy asymmetric capabilities place unique demands upon the FCS and its integrated battle force. A final component of this research is definitive recommendations of potential FCS attributes that should be modeled for subsequent conceptual and operational analysis.

Senior Investigator: LTC Mark J. Davis

Principal Analyst: MAJ Michael J. Kwinn, Jr., Ph. D.

Status: Complete.

Summary:

The United States Army is frenetically engaged in an ambitious initiative to transform itself from a Cold War legacy force into a new millennium force, the Objective Force, designed to dominate potential enemies through the first half of the new century. The centerpiece of this transformed Army is the Future Combat System (FCS). The common expectation of this transformed force is that it will derive its dominance over potential rivals by taking full advantage of a potential Revolution in Military Affairs (RMA) anchored in a host of current and near-future technological advances. Our research presents a more mature understanding of what may ultimately comprise the next RMA and offers a model of battlefield information functional design that can guide FCS system design and that of the Objective Force overall.

We began with an analysis of existing literature attempting to describe or define the term, Revolution in Military Affairs. Our conclusion is that the term is not universally understood, or even sufficiently defined, as to be useful in the context of designing future battlefield systems or future operational doctrine. We assert that a RMA can only occur in an environment in which three pre-conditions are satisfied.

- Fundamentally change the nature of warfare, usually through the application of technological advances;
- Associated doctrinal innovation that employs these advances in novel and significant ways; and
- Organizational acceptance of both the technology and the innovations.

We use historic examples of widely espoused RMAs to highlight the difference between revolutionary and evolutionary changes in military affairs.

After establishing our position on what constitutes a RMA, we turn our analysis to the potential fundamental change in the nature of warfare promised by continuous, collaborative, distributed information operations. Information Warfare promises to revolutionize the entire target engagement process. The target engagement process consists of five distinct battlefield information functions (BIF): Search/Detect, Identify, Track/Target, Engage, and Assess. In platform-centric warfare, responsibility for executing many of the BIF resides in the organic capability of each platform. The evolutionary contribution of technology is to reduce the time required to complete these information functions sequentially. In network-centric warfare, the technology contributes to a potentially revolutionary change in warfare by using assets throughout the battle-space, working continuously and collaboratively in each one of these functional areas, in parallel fashion. An individual platform within the FCS system of systems may thus derive its battlefield potential from a robust information architecture that enhances organic survivability and lethality capabilities through information obtained from other systems within the Objective Force and engagement logic operating at a higher level. This changes the nature of time in combat operations and allows individual systems to be employed to their full potential in terms of the effectiveness of the force as a whole, rather than to the subset of the battlefield they can operate over individually through the target engagement process.

We then shift our discussion to the second precondition of a RMA. In this section, we make three doctrinal recommendations for organizational change and operational employment. The first concerns fire control measures to allow collaborative engagements between adjacent friendly assets. Currently we control fires of friendly units to prevent firing into adjacent unit sectors or to control engagements during a battle within a sector. With the new capabilities afforded by information operations this may not only be unnecessary

given the improved situational awareness, but also may serve to negate the effectiveness of the FCS. The second concerns expanding the span of control of higher headquarters. Our current doctrine limits a headquarters span of control to 3-5 subordinate units. This limitation is based in human factors research, but that research may not fully account for improved automation and situational awareness provided by the FCS. The third concerns information requirements that allow flexibility in the organizational command structure of our forces. We identify some of the information requirements that will allow seamless, effective and efficient augmentation of subordinate forces on the battlefield.

We then address the final, and potentially most difficult precondition for a RMA - organizational acceptance. We establish two mandates to facilitate this effort. The first mandate is to the Modeling and Simulation (M&S) community. They must appropriately and completely model new systems (under design), specifically the distributed collaborative information operations capability envisioned by the Objective Force designers. Simulation efforts to date have focused on modifying current, attrition-based simulations to account for the passing of information. This is insufficient to properly demonstrate the envisioned exponential increase in information operations, which enable the Objective Force capabilities. To this point, simulations have been developed to follow the operational organization, which does not allow the Defense community, and Congress, to fully appreciate the potentials of the new systems. We must change this paradigm. The second mandate is to the analytical and academic communities. These resources must address the specific capabilities of the Objective Force and detail how to achieve those capabilities. This will serve to reduce the speculation and supposition that typifies current operational discussions and reduces confidence in the success of the initiative.

Presentations and Publications:

- Technical Report – A Framework for the Analysis of the Future Combat System Conceptual Design Alternatives. (April 2001)
- "So you say you want a revolution.....", The Project on Innovation and National Security, ed by Mark Pollak, CENSA publication.
- Presentation to US/Canadian OR Symposium (Sept 01)

Personnel Briefed:

- Breifed FCS IPT leads

AN EVALUATION OF JOINT AND SERVICE SPECIFIC ADVERTISING EFFICIENCY FOR MILITARY RECRUITMENT

Client Organization: United States Army Recruiting Command (USAREC)

Points of Contact:

Name:	Address:	Phone:	Other:
COL Greg Parlier	Headquarters, United States Army Recruiting Command (USAREC) 1307 Third Avenue Fort Knox, KY 40121-2726	(502) 626-0321	Gregory.Parlier@usarec.army.mil

Problem Statement:

Using an existing data set, determine whether a Joint advertising strategy is more efficient than a Service-Specific advertising strategy in military recruiting.

Proposal of Work:

The Operations Research Center of Excellence (ORCEN) executed a six-month research project on behalf of USAREC to address whether Service-specific (Army) advertising is more efficient in military recruiting than Joint advertising. We analyzed a data set generated in the early 1980s for a study commissioned by the Department of Defense and conducted by the Wharton Center for Applied Research (WCAR) -- part of the University of Pennsylvania. Due to well-documented problems with the original study, the Department of Defense asked the RAND Corporation to conduct a subsequent study of the data set. The RAND study was not able to glean sufficient evidence from the data to definitively side with either Joint or Service-specific advertising.

In their statistical-econometric analysis of the data set, RAND failed to address inefficiency in the recruiting process, in spite of the efficiency assumption required by the analytical technique that they employed. In this study, we addressed this efficiency issue through the application of Data Envelopment Analysis (DEA). We compared the efficiency of the two programs after removing the "managerial efficiency" found in the recruiting operations within the recruiting districts.

The final results provide an analytical backdrop to USARECs position on this issue in face of increasing pressure to return to Joint advertising.

Senior Investigator: LTC Mark J. Davis

Principal Analyst: MAJ Michael J. Kwinn, Jr., Ph. D.

Status: Completed.

Summary:

This project examined whether advertising money is more efficiently allocated to Joint advertising or to Service-specific advertising (Army, Navy, Air Force, Marines). This is done using data gathered in 1984 under the Department of Defense sponsored "Advertising Mix Test" wherein a designed experiment varied the levels of joint and service-specific advertising across the US and observed the number of recruits obtained. Previous studies have not considered the efficiency with which different entities conduct recruiting activities, and it is possible that a good program can be inefficiently run, or an inferior program can be efficiently run, thus leading to incorrect conclusions if efficiency is ignored. Here we show that in the test data design, the "joint advertising" cells had 5-15 times as many efficient recruiting entities as had the "service specific advertising" cells, and that ignoring this efficiency difference leads to the conclusion that joint advertising is more efficient that service specific advertising. After removing managerial inefficiencies in each program, however, we arrive at exactly the opposite conclusion, namely that when efficiently managed service specific advertising is more efficient that is efficiently managed joint advertising.

Presentations and Publications:

- Technical Report – An Evaluation of Joint and Service-Specific Advertising Efficiency for Military Recruitment (December 2000)
- Article: DEA and Regression Approaches for Evaluating the Effects of Different Military Recruitment Advertising Strategies, submitted to Management Science.
- Article: An Analysis of the Efficiency of Joint Advertising versus Service-specific Advertising for Re ruiting Success, submitted to Military Operations Research Journal.
- Presentation to INFORMS (Nov 2000)
- Presentation to Military Personnel Research Symposium (June 2001)
- Paper submitted to Management Science and MORS.
- Presentation to Client.

SIMULATION AND MODELING FOR ACQUISITION REQUIREMENTS, AND TRAINING (SMART) CURRICULUM

Client Organization: Office of the Assistant Secretary of the Army for Acquisition, Logistics, and Technology (ASA-ALT)

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Problem Statement:

Incorporate the Simulation and Modeling for Acquisition, Requirements, and Training (SMART) initiative into the academic program at the United States Military Academy.

Proposal of Work:

The Operations Research Center of Excellence executed a year-long project as follows:

1. Establishing the SMART Center of Excellence laboratory to offer cadets and faculty the opportunity to learn about and contribute to current SMART efforts through collaborative research with Army agencies. The lab focused on obtaining and integrating software such as finite element programs for component analysis, computer aided design (CAD) programs for subsystem development, visual prototyping programs for system analysis, force effectiveness models to validate system performance under battlefield conditions, and simulation platforms for soldier, crew, and unit training. The integration of the software offers interdisciplinary research opportunities for cadets and faculty in academic disciplines such as engineering, behavioral science, computer science, and military science.
2. Supporting development of a curriculum in Simulation Based Acquisition (SBA) within the Engineering Management Program of Study. The proposed curriculum consist of two sequential case study based courses. The first course introduces cadets to acquisition procedures and life cycle management. The second course emphasizes simulation and modeling efforts throughout the life cycle process.
3. Conducting a survey of simulation and modeling tools within Army, DOD, and private industry acquisition programs to construct a library of past and current acquisition case studies. The primary focus is to develop the case studies for use in the SBA curriculum. However, these studies also benefit other academic programs due to the interdisciplinary nature of the SMART initiative.

Senior Investigator: LTC Willie McFadden

Principal Analyst: MAJ Mark Brantley

Status: Completed

Summary:

The Department of Defense Simulation Based Acquisition (SBA) initiative and the Army's Simulation and Modeling for Acquisition, Requirements, and Training (SMART) initiative focus on identifying opportunities to improve materiel procurement by using information technologies to increase military utility, decrease life cycle costs, and decrease the time to develop and field the system. To fully implement a new perspective and thinking of the acquisition process requires a cultural change. One of the elements necessary to achieve cultural change is education, which can be accomplished through the development and teaching of an acquisition systems management course, in an officer's early informative years. This technical report presents the results from a case study of the Family of Medium Tactical Vehicles (FMTV) program. The report proposes a new holistic methodological approach for developing feasible system courses of action. By using modeling and simulation in the needs analysis phase of the system acquisition life cycle, it is possible to develop and refine the trade space of system requirements to better facilitate acquisition decisions. This technical report, using the FMTV program, conducts a trade space analysis proving the benefits and merits of introducing modeling and simulation early in the acquisition process. In addition, this report identifies lessons learned that support the SBA/SMART initiatives of information and data sharing, as well as, the importance of collecting, tabulating, and reducing the data efficiently.

The relevance of the report results is two-fold. First, this research work highlights the importance of using modeling and simulation early in the acquisition process. Likewise, the research results clearly show why data and information storage and sharing are critical to the effective and efficient acquisition system process. These two tenants of the SBA/SMART initiatives are brought out through a simple but powerful use of trade space analysis to effectively quantify and qualify system requirements. Secondly, the research work validates a more universal acquisition methodology that will be introduced to cadets in the early officer educational process. This will aid in their intellectual development on the acquisition system management and ingrain the principles of SBA/SMART into our total defense acquisition system.

Presentations and Publications

- Brantley, Mark W., Applications of SMART: Family of Medium Tactical Vehicles (FMTV) Case Study, Simulation and Modeling for Acquisition, Requirements, and Training (SMART) Conference, Orlando, Florida, 16 April 2001.
- Brantley, Mark W., Willie J. McFadden, and Mark J. Davis, A Case Study of the Family of Medium Tactical Vehicles (FMTV) for the Simulation and Modeling for Acquisition, Requirements, and Training (SMART) Initiative, Technical Report from the Operations Research Center, United States Military Academy, May 2001.

- Article: Army AL&T (May-June 2001), Acquisition Systems Management Curriculum Development.

Personnel Briefed

- Mr. Hollis, Deputy Undersecretary of the Army for Operations Research, 16 May 2001.
- LTG Kern, Military Deputy to the Assistant Secretary of the Army (ALT), 1 December 2001.
- LTG Flowers, Chief, USA Corp of Engineers, 1 May, 2001.

WARRIOR EXTENDED BATTLESPACE (WEBS) INITIATIVE: DISTRIBUTED SENSOR NETWORKS ON THE FUTURE BATTLEFIELD

Client Organization: US Army Research Laboratory (USARL)

Points of Contact:

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Problem Statement:

The USARL, CECOM and the DBBL are executing the WEBS program. The objective of the WEBS is to demonstrate a family of sensors based on micro electronics and micro electro-mechanical systems (MEMS) technology, to enable overarching situational awareness and provide a common operational picture across all echelons of the Army. WEBS is a five year program covered by a STO and a DTO and is currently in the first year.

The goal of West Point's participation in WEBS is to develop an understanding of the optimal methods to employ WEBS on the battlefield. Understanding how to properly employ improved sensors on the battlefield is an essential fundamental of the WEBS program. Consideration will be given to identifying functions appropriate for WEBS to perform, selection of sensor types and their distribution/location for each function. Consideration will be given to the Anti-Personnel Landmine Alternative program (APLA) since many requirements will be similar.

Proposal of Work:

Phase 1 - Concept Evaluation (Jan 00; ORCEN Analysts)

- Identify functions that distributed sensor networks might serve on the 21st century land battlefield (new or existing functions).

Phase 2 - Scenario Development (Jan 00 through Jun 00; ORCEN Analysts)

- Develop realistic scenarios in which the WEBS would operate.
- Consider current U.S./allied threats and likely OOTW missions.

Phase 3 - Modeling & Simulation (Jun 00 through Jun 01; ORCEN Analysts, Faculty Research and Cadet Capstone Groups)

- Develop computer models and simulations of the distributed sensor networks.
- Evaluate their efficacy to the battlefield functions in the associated scenarios.

Phase 4 - Physical Experimentation (AY 01 through AY 02; AIADs, Faculty Research and Cadet Capstone Groups)

- Test and evaluate physical experiments.
- Utilize indicated by the results of the simulation-based experiments.

Senior Investigator for Overall Project: LTC Mark J. Davis

Principal Analyst: MAJ Michelle McCassey

Status: Continues through FY 2001

Summary:

In response to the changing operational environment facing the nation and the Army during the 21st Century, the Chief of Staff and Secretary of the Army announced a new Army Vision in October 1999 to build a land-power force capable of strategic dominance across the full spectrum of operations. The Vision establishes an explicit requirement for the Army to become more strategically responsive. The Army will implement the Vision by means of a three-stage transformation campaign over the next 10-20 years, leading to the establishment of an Objective Force that will incorporate revolutionary improvements in capability over the current force. The Army Transformation Campaign Plan represents the most challenging and significant effort to change the Army in a century. The IBCT represents the vanguard of that future force.

A future notional system is envisioned of remotely or manually deployed sensors that self-organize into a fused information source. If microsensing is successful, we will hopefully be able to replace landmines by arrays of acoustic, IR and other small sensors. The hope is that sensors will improve situational awareness, decrease response time, and increase the transparency of the battlefield to allow the ground component commander to make more informed decisions and employ weapons and systems more precisely.

This paper uses a systems engineering framework to understand and define a given problem. Through extensive literature research, it then addresses the variety of deployment platforms available and planned along with the latest versions of the IBCT and the RSTA Squadron who will potentially deploy these networked sensors. Finally, the foundation for an optimization model framework is explained, highlighting many of the issues surrounding the emplacement of networked sensors.

Presentations and Publications:

- Technical Report – Optimal Deployment Measures Research for Networked Sensor Technologies as part of the Future Combat System. (July/August 2001)

Personnel Briefed:

- Briefing to Client

ENLISTED BONUS DISTRIBUTION MODEL (EBDM)

Client Organization: United States Army Recruiting Command

Points of Contact:

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Problem Statement:

Each quarter representatives from the United States Army Recruiting Command (USAREC), the Office of the Deputy Chief of Staff Personnel (DCSPER) and the Personnel Command (PERSCOM) meet to form the Incentive Review Board (IRB). The task of the IRB is to determine what is the optimal mix of enlistment incentives to offer in order to maximize recruiting production while remaining within the operating budget. The board currently has no formal decision support tool to assist them in this process. Develop a dynamic model which will enable USAREC to efficiently allocate its roughly $200 million annual recruiting budget among the possible enlistment incentives. A mix of the available enlistment incentives is used to attract the required number of enlistees for all critical MOSs. The model must evaluate 194 entry level MOSs and include all enlistment incentive packages evaluated in the Choice Based Conjoint (CBC) analysis done by MarketVision Research.

Proposal of Work:

Develop in conjunction with USAREC, a dynamic pre-emptive goal program, which has two goals. The first goal is to minimize the deviation from the target number of enlistees and the total enlistment incentive budget. This goal attempts to achieve the target number of enlistees required for each critical MOS as the first priority while remaining within or below the budget is a second priority. The second goal is to minimize total cost without falling below the minimum required number of enlistees. The model will be dynamic in that the MOSs will be represented by binary variables allowing the user to select which MOSs are critical and allocate the budget among only these critical MOSs

Senior Investigator: Dr Gregory Parnell

Principle Analyst: MAJ Todd M. Henry

Status: Complete

Summary:

Periodically, representatives from the United States Army Recruiting Command (USAREC), the Office of the Deputy Chief of Staff Personnel (DCSPER) and the Personnel Command (PERSCOM) meet to form the Enlisted Incentive Review Board (EIRB). The task of the EIRB is to determine the enlistment incentives to offer for each MOS to ensure the Army meets recruiting goals while remaining within the recruiting budget. The current method of assigning enlistment incentives does not consider recruit preferences for incentives and thus cannot predict the number of enlistments for a given incentive nor can it evaluate the effects of new incentives. The EIRB requires a quantitative decision support tool that will assist the members in doing the following: predict the number of individuals who will enlist into a given MOS over a certain time of service for a given incentive; determine the optimal mix of incentives to offer for each MOS to meet its recruiting goal; minimize the deviation from the recruiting goals for each MOS to remain within the recruiting budget. This paper describes the methodology used to create such a decision support tool, known as the Enlisted Bonus Distribution Model.

USAREC contacted the Operations Research Center to develop such a decision support tool and requested that it be flexible, 'user friendly', and accommodate all entry-level MOSs. A binary integer goal program proved to accurately model the enlistment incentive environment and also met USAREC's requirements.

The Enlisted Bonus Distribution Model uses Microsoft Excel® and the Extended Large-Scale Solver® produced by Frontline Systems, Inc. The model can evaluate 194 entry-level MOSs and over 330 incentives, which results in over 64,000 decision variables. The model uses results from a choice-based conjoint study to predict the number of recruits per MOS, incentive and term of service. These predictions are used, with incentive costs and recruiting budget, to determine the optimal mix of incentives to offer a MOS that minimizes the deviation from its recruiting goal.

The model performs well in the solution space and produces reasonable answers after executing 1,000 sub-problems. The run times using a 450MHz desktop PC averaged about 75 minutes. Model input data is obtained from existing personnel reports that are copied into the worksheet, making it is easy to update with new information.

The Enlisted Bonus Distribution Model is a flexible, effective tool for determining enlistment incentives. Taking results from the choice-based conjoint study, the model determines enlistment incentives to meet recruiting goals while remaining within the recruiting budget. The model is also an effective tool for recruiting budget planning.

Presentations and Publications

- Technical Report – EBDM Decision Support Tool (Sept 2001)
- Presentation on EBDM Decision Support Tools, 69th Annual MORS Conference, US Naval Academy, Annapolis, MD, June 2001

Personnel Briefed:

- Briefed USAREC PA&E Chief (Februray 2001)
- PERSCOM – Briefing to USA Enlisted Incentive Review Board (March 2001)

BASE CAMP DESIGN FOR OPERATIONS OTHER THAN WAR (OOTW)

Client Organization: ORCEN, Department of Systems Engineering

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LTC Jimmy Danna	C5 G3 DELIBERATE PLANS OIC	DSN 370-5380	G3PLNDELOIC@HQ.C5.ARMY.MIL
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Problem Statement:

USMA graduates face the prospect of deploying to conduct operations other than war because small-scale contingency deployments have become commonplace. A typical mission that junior officers encounter is deployment to set up and occupy a base-camp to conduct OOTW. Using a Bosnia Base Camp design scenario, we apply the engineering thought process to formulate, analyze and implement alternative base-camp sites.

Proposal of Work:

The Operations Research Center of Excellence (ORCEN) executes research to develop a multi-disciplinary, methodologically grounded problem solving approach to the task of designing and implementing base camps and force protection infrastructures under OOTW task and environmental conditions. The research will also generate a prototype capstone for USMA faculty and cadets. During academic term 01-1 four systems engineering cadets will assist an ORCEN analyst in problem definition for a deployment to conduct operations other than war.

Systems engineering cadets conduct a detailed mission analysis for a deploying brigade combat team to Bosnia. The semester concludes with a deployment model, base camp location and overall concept of the operation.

During the spring semester (01-2), engineering management cadets join the team and together conduct modeling, analysis and implementation of the best base-camp design alternative, given the location determined in the first semester. Given that the problem of base camp selection is multi-disciplined, we encourage participation by Departments of Mathematical Sciences, Geography and Environmental Engineering, and Military Science faculty and cadets. A distinguishing characteristic of this capstone design is a cadet team that is task organized with skills from many different educational disciplines focused on solving a complex, significant and relevant Army problem: base-camp selection to support OOTW deployments. Highlights from 01-2 semester will be the use of JACE-Joint

Assessment of Catastrophic Events model and the creation of a decision support system that facilitates COA analysis and specifically risk assessment.

Senior Investigator: LTC Mark J. Davis

Principle Analyst: MAJ Barry Ezell

Status: Work continues through AY 01

Summary:

[We need] a better primer or planning guide for the design, construction, and sustainment of base camps must be developed. This must be an integrated product that includes general engineering considerations, field sanitation, force protection concerns, and environmental-related considerations. -- Colonel Michael A. Hiemstra, Director, Center for Army Lessons Learned

Up front to this whole effort there needs to be some sort of setting the stage - for the theater and political leadership - to understand what it means when we say we are going to deploy and base troops for a time (months to years), on foreign soil. We all must come to agreement that it means this in terms of living conditions, this in terms of support (everything from hospitals to AFN), etc., etc. I've often argued we need an Army wide "son of Red Book", that when a decision is made to put troops into Sierra Leone or

Bosnia, it will mean this; it will mean that. – Colonel Robert McClure, 1st Engineer Brigade, 1st ID (M)

Army deployments to conduct operations other than war have been sustained by base camps for 225 years. In other words, base camp development is not a new endeavor. However, the larger footprint required by the logistical demands of modern equipment coupled with deployments in urban regions have created an environment where site selection and facility layout within a base camp become difficult problems. Increased environmental awareness, new construction standards to address force protection and soldier morale, and life-cycle cost make base camp location and layout an important Army issue. Therefore, base camp design, management and reengineering should proceed from a systems engineering perspective in order to adequately address these complex and interrelated requirements.

The Army has numerous field manuals, technical manuals and policy documents that discuss techniques, standards, and requirements for base camp construction. However, military planners do not have doctrinal guidance, an information repository, or a decision support tool to aid commanders in selecting the best locations for base camps. Location decisions are usually based on tactical considerations derived from intelligence preparation of the battlefield (IBP) for the deployment and anticipated OOTW missions. Typically, a unit arrives and occupies an assembly area. Over time the location evolves into a de`facto base camp location. Military planners would also benefit from a decision support tool that optimizes the facility layout for a base camp location while providing flexibility for modification and expansion. This executive summary presents our progress in determining base camp functions and the very specific knowledge requirements for base camp site-selection and facility layout. It concludes with a discussion about the future research, highlighting the system requirements for the decision support system.

A first step in addressing this problem is to clearly define a base camp and identify its primary functions. To this end, we define a base camp as an evolving military facility that supports the military operations of a deployed unit and provides the necessary support and services for sustained operations. Using this definition, a base camp's primary function is mission support. To accomplish this support, it must provide four key services: force protection, critical infrastructure, training support, and maintenance support. A functional decomposition of these services provides insight for base camp location and facility layout decisions. Force protection programs must safeguard and secure people, facilities, equipment, supplies, transportation networks, and information. These programs must adapt to the threat, mission, and environment.

Classifying the critical infrastructure will help managing the base camp real estate by creating zones similar to those used by city master planners. Typical base camp infrastructure can be classified as housing, soldier support, unit support, and morale-welfare-recreation. Housing is further defined by type such as tent or sea hut. Unit support is decomposed into elements that include motor pools, unit headquarters, electric power, water (potable and treatment), road networks, fuel storage, and ammo holding areas. The soldier support component is representative of areas in the base camp dedicated to dining facilities, aid stations, chapels, education center, postal service center, mail rooms, finance support, barber, post exchange, food concession and fire protection. The morale-welfare-recreation component is comprised of fitness centers, theater center, common areas, library, TV rooms, athletic fields, and running trails. OOTW missions make individual and collective training support critical.

Units need areas to train on tasks they may not normally perform. They also require training resources to maintain proficiency on essential tasks that they probably will not perform in theater. Equally important is providing maintenance areas and facilities to support equipment and facility. These component lists for the four critical services are not exhaustive and are a function of resources, politics and time. In general, the larger the facility and length of deployment will impact on the number and types of facilities. The important point is that stakeholders desire quality of life for deployed soldiers and theater commanders establish the guidelines on facilities. A few more components of the definition need emphasis. A base camp supports a deployed unit. Although the camp may have permanently assigned personnel, the units will rotate through the facility. The next point is that the base camp provides for sustained operations. This implies a requirement for continuous re-supply and the establishment of a logistical support structure. Although assembly areas may provide many of the services in austere base camps, they usually lack the ability for sustained logistical support.

Stakeholders are individuals who can influence decision outcomes. They are key players-- internal or external to an organization and either controllable or uncontrollable. Since base camp location is closely coupled with early decisions on assembly area location, deploying units would benefit from a system that incorporates environmental, political, economic, geographic, and infrastructure considerations. The most obvious stakeholders are commanders and their staffs. These headquarters range from the Commander-in-Chief of a unified command to the units occupying and supporting a base camp. The commanders are responsible for decision-making, and their staffs must provide them with adequate information to make the decisions. The principle staff agencies include those responsible for personnel, operations, engineer, logistics and resource management functions. These agencies desire a fair and equitable quality of life consistent with resource, political, and military constraints. Additional staff stakeholders are those who levy requirements on the location and layout of base camps. For example, signal officers have a stake because of the impact of communications: satellite, FM, HF, email, etc. There also

agencies that are not in the chain of command that impose requirements on the base camp location and design. Safety officers from DOD agencies have a stake because they certify the base camp as safe. DOD Antiterrorism Force Protection (AT/FP) Program implements a Joint Staff Integrated Vulnerability Assessments (JSIVA) to review installation AT/FP programs. The JSIVAs look at physical security measures, AT/FP training, operational intelligence fusion, structures, and plans for responding to terrorist incidents. In fact, there are a host of outside agency stakeholders (with requirements) that have an impact on location and layout. Contract personnel, host nation governments, local populations, United Nation agencies, non-governmental organizations, environmentalist, and local industries are a few examples.

Developing a common language is critical to facilitate future base camp discussion, research, planning, and execution. Aside from acknowledging the basic functions and components, base camps should also be classified in terms of states, hierarchical structure and lifecycle. The "state of the system" is a time-dependent description that captures the operational essence of the system (base camp). The operational states of the base camp may be viewed in terms of capability and lifespan. Capability can be characterized by commonly used schemes such as mission capable, non-mission capable and fully mission capable or red, amber, and green. The construction state is characterized as temporary or permanent.

A convenient manner to address hierarchy is to characterize the system in terms of base camp type or level of command. They are three types of base camps: major base camp, remote site, or forward operating site. Additionally, one can identify a base camp or system of base camps by command level. Commands levels are geographic combatant, area, base camp cluster, tenant, remote site, or forward operating site commander. Finally, base camps should be understood in terms of lifecycle. We identified nine lifecycle functions for base camps: deciding, designing, locating, constructing, operating, maintaining, upgrading, deactivating, and retiring.

A prototype decision support system is in the early stages of design in the ORCEN. Based on stakeholder and needs analysis, we believe the system should support critical site location and facility layout decisions. The site selection prototype DSS (GeoBLAST) accepts inputs such as: user type, mission, area of operation, mission duration, alternative locations, value assignment to evaluation measures, and weight assignment to knowledge categories. These inputs are transformed via a knowledge hierarchy and rule base implementation into system outputs, which include site selection, resource requirements, facility layout and general knowledge. Finally, the system provides layout configuration for the components of a base camp where the component selections are a function of force protection, base camp size, mission, duration, and unit type.

Over the next 18 months, cadets and faculty at the US Military Academy will deploy to several overseas locations collecting data for potential base camp locations in support of OOTW contingencies. Engineering capstone teams will use this data to refine decision-making models and instantiate knowledge bases useful to detailed planning within the specific geographic areas studied.

Presentations and Publications

- 8-11 October 2000 Presented two papers and chaired the special session entitled: Military Systems Engineering Applications. The 2 papers were: "Designing an

OOTW Knowledge Hierarchy for an OOTW Decision Support System for Military Planners" and "Joint Military Headquarters Design".

- 15-17 October 2000 presented a paper: "Base Camp Design" and served as a panel member on critical infrastructure for the Engineering Foundation Conference on Risk-Based Decision Making in Water Resources IX.
- 5-7 June 2001 presented a paper on multi-disciplinary capstones at USMA and served as a panel member for "Trends in Education" at the Society of American Military Engineers' National Conference
- Mark W. Brantley and Barry C. Ezell, "Analysis Paradigms: Are you thinking on-, in-, or outside-the-box?", Military Engineer, Vol. 93, No. 612, 2001.
- Barry C. Ezell, Mark W. Brantley, and Mark J. Davis, "Base Camp Design: Developing a Decision Support Tool for Site Selection and Facility Layout", Military Engineer, Vol. 93, No. 610, 2001.
- Matthew U. Robertson, Barry C. Ezell, and Michael L. McGinnis, "Base Camp Facility Layout", IEEE 2001 International Conference on Systems, Man and Cybernetics, to be published in the October 2001 Proceedings.
- Randall Klingaman, Ricardo O. Morales, Barry C. Ezell, and Michael L. McGinnis, "Using Cluster Analysis to Develop a Uniformed Joint Task List For Rapid Decisive Operations", IEEE 2001 International Conference on Systems, Man and Cybernetics, to be published in the October 2001 Proceedings.
- Barry C. Ezell, Yacov Y. Haimes, and James H. Lambert, "Risks of Cyber Attack to Water Utility Supervisory Control and Data Acquisition Systems", Military Operations Research Society, Vol. 6, No. 2, 2001.
- Greg Parnell, Barry C. Ezell, Yacov Y. Haimes, Kent Schlussel and Mark Sulcoski, "Designing a OOTW Knowledge Hierarchy for a OOTW Decision Support System for Military Planners", Phalanx: A Bulletin for the Military Operations Research Society, December, 2000.
- Barry C. Ezell, Daniel J. McCarthy, William L. Ratliff, Jr., and Michael L. McGinnis, "Joint Military Headquarters Redesign", IEEE 2000 International Conference on Systems, Man and Cybernetics, October 2000 Proceedings.
- Barry C. Ezell, Gregory Parnell, Yacov Y. Haimes, and James H. Lambert, "Designing an OOTW Decision Support System Military Planners", IEEE 2000 International Conference on Systems, Man and Cybernetics, October 2000 Proceedings.
- Barry C. Ezell, Mark J. Davis, and Michael L. McGinnis, "Designing A Decision Support System For Military Base Camp Site Selection And Facility Layout", Engineering Foundation Conference on Risk-Based Decision Making in Water Resources IX Proceedings, October 2000.
- Barry C. Ezell, John V. Farr, and Ian Wiese, "The Infrastructure Risk Analysis Model", The American Society of Civil Engineers (ASCE): Journal of Infrastructure Systems, Vol. 6, No. 3, 2000.
- Barry C. Ezell, John V. Farr, and Ian Wiese, "An Infrastructure Risk Analysis of a Municipal Water Distribution System", The American Society of Civil Engineers (ASCE): Journal of Infrastructure Systems, Vol. 6, No. 3, 2000.

Personnel Briefed

- LTG Flowers, Chief, USA Corp of Engineers, 1 May, 2001

Part III - Documentation

TECHNICAL REPORTS

The Operations Research Center and the Department of Systems Engineering publish interim and final results from projects and studies in the form of Technical Reports. Below is a listing of the reports published during AY01.

TITLE	AUTHORS
Utilities Privatization in the US Army: Economic Analysis and Process Improvement Strategies	MAJ Ricardo Morales
A Framework for the Analysis of the Future Combat System Conceptual Design Albernatives.	MAJ Michael J. Kwinn, Jr.
An Evaluation of Joint and Service Specific Advertising Efficiency for Miliatary Recruitment	MAJ Michael J. Kwinn, Jr.
Simulation and Modeling for Acquisition Requirements, and Training (SMART) Curriculum	MAJ Mark Brantley
Warrior Extended Battlespace (WEBS) Initiative	MAJ Michelle McCassey
Enlisted Bonus Distribution Model (EBDM)	MAJ Todd Henry
Base Camp Design for Operations Other Than War (OOTW)	MAJ Barry Ezell

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